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ABSTRACT

This paper proposes a model for teaching and learning complex thinking skills developed from a synthesis of theories and research. The model functions like a concept map or a graphic organizer with five major components, each discussed in this paper: (1) presence of complex authentic life situations within a context; (2) activation and execution of complex thinking skills; (3) development of interactive prerequisites of content, simple thinking skills, and dispositions and habits; (4) inclusion of connecting networks and operations (linkages, schemata, and scaffolding) to bridge complex thinking skills with interactive prerequisites; and (5) targeted teaching and learning strategies. Terms associated with thinking and learning guided the manual and electronic search through the Internet and online library files. (Contains 70 references.) (Author/AEF)

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Teaching and Learning Strategies for Complex Thinking Skills

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Abstract

This paper proposes a model for teaching and learning complex thinking skills developed from a synthesis of theories and research. The model functions like a concept map or a graphic organizer with five major components: (1) presence of complex authentic life situations within a context; (2) activation and execution of complex thinking skills; (3) development of interactive prerequisites of content, simple thinking skills, and dispositions and habits; (4) inclusion of connecting networks and operations (linkages, schemata, and scaffolding) to bridge complex thinking skills with interactive prerequisites; and (5) targeted teaching and learning strategies. Terms associated with thinking and learning guided the manual and electronic search through the Internet and on-line library files.

Background

There are known instructional strategies to support the learning of different types of knowledge and skills (Merrill, Drake, Lacy, Pratt, & the ID2 Research Group, 1996), and for the most part, these were identified by observing the conditions of learning across six decades of study. Classifications of learning outcomes tend to progress from simple to complex (Bloom, 1956; Briggs & Wager, 1981; Bruner, 1990; Clarke, 1990; Dewey, 1933; Gagné, 1985, 1989; Gagné & Briggs, 1974; Gagné, Briggs, & Wager, 1988; Costa, 1990; Cotton, 1997; Glaser, 1941; Guilford cited in Crowl et al, 1997; Haladyna, 1997; Jonassen, n.d.; Marzano, 1993, 1994; Marzano, et al, 1992; Marzano, et al, 1988; Merrill, 1987; Merrill et al, 1996; McREL, 1997; Piaget cited in Crowl et al, 1997; Sternberg, 1998; Sternberg & Davidson, 1995; Sugrue, 1995; Vygotsky cited in Crowl et al, 1997).

Many publications cite the distinction between lower order and higher order thinking skills (Arter & Salmon, 1987; Carnine, 1993; Clarke, 1990; Ennis, 1989; Fogarty & McTighe, 1993; Crowl et al, 1997; Kauchak & Eggen, 1998; Kirby & Kuykendall, 1991; Lewis & Smith, 1993; McDavitt, 1993; McGregor, 1993; Paul & Nosich, 1992; Weisberg, 1995; Young, 1997). Some refer to tasks requiring *increased levels of processing* (cognitive: classifications, rule or procedural executions) and others to tasks demanding *high levels of processing* (constructive: heuristic problem solving, personal selection and monitoring of cognitive strategies) (Ertmer & Newby, 1993).

Yet, the definition of complex thinking skills has been referred to as a *conceptual swamp* (Cuban cited in Lewis & Smith, 1993, p. 1) and *...a century old problem* for which *there is no well-established taxonomy or typology* (Haladyna, 1997, p. 32). What is unknown also has been described as follows.

> *...While advanced knowledge, higher order thinking, problem solving, and transfer of learning evoke common associations and expectations in most of us, there remains an operational inexactitude in these constructs..these learning outcomes can best be operationalized and predicted by assessing and understanding learners' mental models of the problem or content domain being learned....*
>
> Jonassen, n.d., p. 1

A Model for Teaching and Learning Strategies

Figure 1 represents a synthesis from theories of learning and research associated with complex thinking skills. This model functions like a concept map or graphic organizer (Ausubel, 1968; Clarke, 1990; Kealy, 2000; Jonassen, 1996; NCREL, 1988; Novak, 1990; Plotnick,1997). It shows components, linkages, relationships, and interactions for teaching and learning complex thinking skills. The narrative further explains the relationships among the five components: (1) presence of complex authentic life situations within a context; (2) activation and execution of complex thinking skills; (3) development of interactive prerequisites of content, simple thinking skills, and dispositions and habits; (4) inclusion of connecting networks and operations (linkages, schemata, and scaffolding) to bridge complex thinking skills with interactive prerequisites; and (5) targeted teaching and learning strategies.

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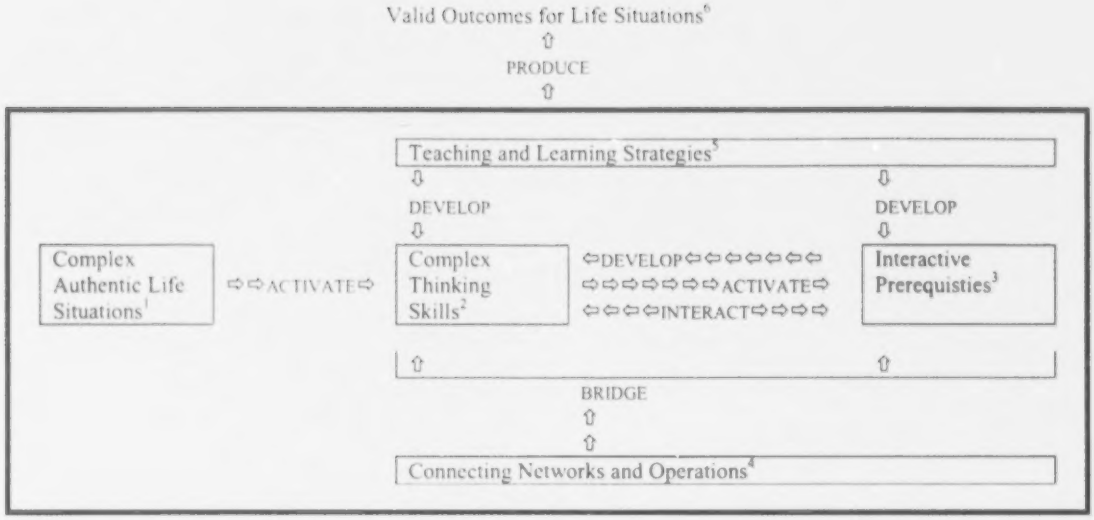

Figure 1. A Model for Teaching and Learning Complex Thinking Skills

[1]**Authentic Life Situations.** Situations of multiple categories for which the student has not learned answers, preferably real-life context. Examples: ambiguities, challenges, confusions, dilemmas, discrepancies, doubt, obstacles, paradoxes, problems, puzzles, questions, uncertainties.

[2]**Complex Thinking Skills.** Multidimensional skills using more than one rule to manage a life situation or transforming known concepts and rules to fit the situation. Examples: complex analysis, creative thinking, critical thinking, decision making, evaluation, logical thinking, metacognitive thinking, problem solving, reflective thinking, scientific experimentation, scientific inquiry, synthesis, systems analysis.

[3] **Interactive Prerequisites.** Content, simple thinking skills, and learner dispositions and habits.

Content. Content includes subject area content (vocabulary, structure, concept definitions, procedural knowledge, reasoning patterns) and thinking content (thinking terms, structures, strategies, heuristics, and processes).

Simple thinking skills. Simple thinking skills include cognitive strategies, comprehension, concept classification, discriminations, routine rule using, simple analysis, and simple application.

Dispositions and habits. Dispositions and habits include attitudes, adaptiveness, tolerance for risk, flexibility, openness; cognitive styles (such as field dependence, locus of control, response rates); habits of mind (persistence, self-monitoring, self-reflection); multiple intelligences (linguistic-verbal, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal).

[4] **Connecting Networks and Operations.** Bridges between interactive prerequisites and complex thinking skills related to the life situations by means of linkages, schemata, and scaffolding.

Linkages. Linkages involve the extension of prior learning to the new context and higher order skills. They may require mastery or automatization of prior learning. It is important to link new knowledge and skills with prerequisites.

Schemata. Schemata may be a network, organization, representation, or architecture for organizing new learning so that it makes sense to the learner.

Scaffolding. Scaffolding includes the guidance, structure, visual and verbal representations, and modeling of complex thinking skills.

[5]**Teaching and Learning Strategies.** Teaching and learning strategies for the interactive prerequisites and complex thinking skills provided in a learning environment that is considered safe, motivating, and supportive. Learning progresses in levels, each elaborating on previous levels, and connecting previously learned knowledge and skills to the next higher level.

[6] **Valid Outcomes for Life Situations.** Outcomes will be valid for life situations when they are managed or resolved within their context, including conditions, resources, constraints, and criteria.

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Complex thinking skills will develop more fully when teachers and instructional programs align learning activities with authentic life situations and provide scaffolding to help learners move from simple through progressively more complex content, processes, and outcomes. In life situations, individuals must be able to select, organize, and sequence knowledge, thinking skills, and dispositions relevant to the life situations that they encounter. They must be able to apply content knowledge and thinking models or strategies to productively manage various life situations.

In order to develop the cognitive structure that is most consistent with complex thinking skills, learners must have opportunities to achieve increased generality and complexity in thinking applications, with practice beginning within the lower-order levels of content and learning outcomes. The importance of developing this cognitive structure and the role of guidance and practice has been well established (Merrill, 1987). The benefit for progressive movement from simple to increasing complexity also has been well established (Ausubel, 1968; Clarke, 1990; Crowl et al, 1997; Kauchak & Eggen, 1998; Marzano et al, 1988; McREL, 1997; Wilson & Cole, 1992).

Authentic Life Situations

Knowledge develops within each individual through learning events in education and everyday life (Bruner, 1990; Dewey, 1933; Jonassen, 1999). Most problem situations are multicategorical and not domain-specific (McPeck, 1990). An action-based learning environment depends on immersion with real-world or authentic problems (Ausubel, 1968; Dewey, 1933; Glaser, 1941; Huot, 1998; Jacobs, 1995; Jonassen, 1999; Jonassen, Merrill, Reigeluth, and Rowland, 2000; Marzano et al 1988; McREL, 1997; Vygotsky, 1978). Yet, life engages people in many situations that may require complex thinking, not just problems to be solved.

In addition to problem solving, other purposes achieved through complex thinking skills include finding problems, incompleteness, anomalies, troubles, inequities, and contradictions; developing methods of inquiry; making decisions; making choices, creating new ideas or objects, and making predictions (Cotton, 1997; Gagné, Briggs & Wager, 1988; Kahneman, Slovic & Tversky, 1982; Lewis & Smith, 1993; McREL, 1998; Tversky & Kahneman cited in Ohio State University, n.d.; Wilson & Cole, 1992).

Complex Thinking Skills

Complex thinking skills encompass the higher level skills defined in Bloom's Taxonomy of Educational Objectives (Bloom, 1956); the problem-solving level of skills in the hierarchy of learning capabilities described by Briggs and Wager (1981), Gagné (1985), and Gagné, Briggs, and Wager (1988); the critical thinking skills identified in Gubbins' *Matrix of Critical Thinking Skills* (cited in Legg, 1990); and the kinds of critical thinking, problem solving, decision making, and creative thinking skills described by Lewis and Smith (1993).

Terms used to describe complex thinking skills have been diverse, including active inquiry and discovery, creative thinking, critical thinking, decision-making, evaluation, higher order thinking, inquiry, insight, logical thinking, metacognition, problem solving, scientific reasoning, rational thinking, reflective thinking, synthesis, and systems analysis (Bloom, 1956; Bruner cited in Crowl et al, 1997; Cotton, 1997; Crowl et al, 1997; Csikszentmihalyi & Sawyer, 1995; Dewey, 1933; Ennis, 1989, 1993; Facione, 1998; Fogarty & McTighe, 1993; Gagné, Briggs & Wager, 1988; Gick & Lockhart, 1995; Glaser, 1941; Gruber, 1995; Haľadyna, 1997; Kahneman, Slovic & Tversky, 1982; Kauchak & Eggen, 1998; Legg, 1990; Lewis & Smith, n.d., McREL, 1998; Piaget cited in Crowl et al, 1997; Pogrow, 1999; Pogrow & Buchanan, 1985; Siowick-Lee, 1995; Sternberg & Davidson, 1995; Tversky & Kahneman cited in Ohio State University, n.d.; Utah State Office of Education, 1997).

For the purpose of focusing the model presented in this paper, a complex thinking skill is one that involves the application of at least two rules or principles to a situation with multiple factors. It is *productive* rather than only *reproductive* thinking (Maier cited in Lewis & Smith, n.d., p. 6). It requires going beyond applying routine rules, beyond the routine application of previously learned knowledge (Newman cited in Lewis & Smith, n.d., pp. 7-8). It may involve the *putting together of certain rules that may not have been applied to previous similar situations* (Gagné, Briggs & Wager, 1988, pp. 65-66). In this process, concepts and rules must be *synthesized into new complex forms for the learner to cope with new problem situations* (Gagné, Briggs & Wager, 1988, pp. 65-66).

In Gagné's framework, intellectual skills begin with discriminations as a prerequisite for concrete and defined concepts, simple rules, and then more complex higher order rules and problem solving. The application of at least two rules defines the problem solving level of learning (Briggs & Wager, 1981; Gagné, 1985; Gagné, Briggs & Wager, 1988).

Though focused on process or biological development or stages of development, other learning theories also express levels of increasing complexity. For example, in Bloom's taxonomy, lower levels of learning provide a base for higher levels of analysis, synthesis, and evaluation. Piaget and Bruner focus on different processes for acquiring skills, but both include the importance of linking previously learned concepts and information to new

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learning (Crowl et al, 1997; Hummel 1997). Bruner's spiral curriculum has long served as a model for developing higher levels of complexity over periods of time (Bruner cited in Crowl et al, 1997). Vygotsky observed that cognitive development progresses as children learn and that internalizing knowledge facilitates higher mental functions (Crowl et al, 1997). Finally Marzano and McREL have focused on developing dimensions of thinking and learning in which core thinking skills and more complex thinking processes interact with types of knowledge (Marzano et al, 1988; McREL 1997).

It is most important that individuals make *acquaintance with the particular facts that create a need for definition and generalization* in order to see *the correct difficulty to be overcome* not with *definitions, rules, general principles, classifications, and the like* (Dewey, 1933, p. 186). Perceiving the correct difficulty is particularly important because the way a problem is *apprehended or defined limits the kind of answers that will occur to the thinker* (Glaser, 1941, p. 25). Individuals must be able to reformulate issues and steer the thinking process in the right direction.

Individuals must be able to combine new with familiar information and skills creatively within limits set by the material or context (Bloom, 1956; Bloom cited in McDavitt, 1993). The interplay of multiple intelligences, insight, and creativity also fits within the concept of complex thinking skills.

Intelligence, no longer limited to the idea of a single ability or global capacity to learn, is characterized by multiple dimensions of mental processes, types of information, and types of outcomes involving convergent and divergent thinking (Crowl et al, 1997). These different abilities contribute to success with different types of subject matter content, approaches to thinking strategies, and ways of coping with new and unfamiliar life situations (Guilford cited in Crowl et al, 1997; Thurstone cited in Crowl et al, 1997; McPeck, 1990; Gardner, 1983; Gardner cited in Crowl et al, 1997; Sternberg, 1998; Sternberg & Lubart, 1995; Sternberg cited in Crowl et al, 1997).

Insight, a concept often associated with creativity, manifests itself in the sudden unexpected solution to a problem (Schooler, Fallshore, & Fiore, 1996). Non-insight problems require routine application of rules, while insight problems require problem solving and cognitive strategies or analysis, synthesis, and evaluation (Gagné, Briggs & Wager, 1988; Bloom, 1956). Insight may be a product of the prepared mind because *only a trained mind can make connections between unrelated events, and recognize meaning in a serendipitous even,* and produce a solution which is both novel and suitable (Pasteur cited in Crowl et al, 1997, pp. 192-193). Insight has been characterized as involving the access of appropriate problem elements, the search for a new problem representation, the finding of alternative approaches, the habit of persevering, the taking of risks, the application of broad knowledge, and the recognition and use of analogies (Schooler, Fallshore & Fiore, 1995).

Creativity, often characterized by fluency, originality, and elaboration, requires going beyond previously learned concepts and rules to generate rather than merely reproduce something (Crowl et al, 1997). Creative problem solving involves finding problems, working to find fresh ways to view them, evaluating shortcomings and weaknesses, selecting relevant aspects for attention while ignoring the irrelevant, and putting the pieces together in a coherent system that integrates the new information with what an individual already knows (Barron & Harrington cited in Crowl et al, 1997; Hebb, Perkins, & Smith cited in Sternberg & Davidson, 1995; Sternberg & Davidson, 1982, 1983; Davidson & Sternberg cited in Crowl et al, 1997). Examples of products resulting from the creative process include Benjamin Franklin's application of conservation and equilibrium (Crowl et al, 1997); Picasso's *Guernica* resulting from sketches and modifications of previous work (Weisberg, 1995); Coleridge's *Kubla Khan,* a product of numerous revisions (Crowl et al, 1997); Watson and Crick's discovery of the DNA double helix structure (Weisberg, 1995; Crowl et al, 1997; Edison's invention of an electric lighting system (Weisberg, 1995; Crowl, 1997).

In this model, metacognitive strategies have been classified as complex thinking with the focus on their executive control function—evaluating, planning, and regulating thinking processes. Some metacognitive strategies might be considered simple thinking skills, while others would be complex. Metacognitive strategies include problem finding and the linkage of problem finding and creativity through activities of planning, self-monitoring of progress, and self-adjustments to thinking strategies (Gagné, Briggs & Wager, 1988; Sternberg & Lubart, 1995; McREL, 1998; Young, 1997).

The cognitive development involved in complex thinking also leads to more efficient learning of both facts and skills (DeVries & Kohlberg, 1987; McDavitt, 1993; Schwartz & Reisberg cited in Crowl et al, 1997; Son & VanSickle, 1993).

Interactive Prerequisites

Content is a building block for thinking skills. The recall of content is verbal information. Whether or not thinking can be learned without content is only a theoretical point because education and life engage both. Individuals take current knowledge and interrelate or rearrange it together with new information, using thinking

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skills, which then function to extend and refine knowledge (Huot, 1998; Marzano et al, 1988; McREL, 1997). As learners build relationships among concepts, they broaden their knowledge of the world and begin to form rules to use in problem situations (Gagné, Briggs & Wager, 1988).

Content *begins in relatively simple forms and grows towards complexity* and the nature of thinking *adapts to increasing challenge* (Clarke, 1990, p. 24). Mastery of content and simple thinking skills are particularly important prerequisites because *any lesser degree of learning...will result in puzzlement, delay, inefficient trial and error at best, and in failure, frustration, or termination of effort toward further learning at the worst* (Gagné, Briggs & Wager, 1988; cf. Bloom cited in McDavitt, 1993).

Examples of objectives that express the need for complex thinking skills in particular subject matter areas include the ones listed below (Florida DOE, 1996).

- Math: *uses and justifies different estimation strategies in a real-world problem situation and determines the reasonableness of results of calculations in a given problem situation.*
- Language Arts: *selects and uses strategies to understand words and text, and to make and confirm inferences from what is read, including interpreting diagrams, graphs, and statistical information.*

Dispositions and habits contribute to the success of thinking in developing valid outcomes for life situations. They include an individual's tendencies and behaviors to seek accuracy and clarity, restrain impulsivity, take a position or direction, exercise self-regulation, think critically and creatively, set goals, make and execute strategic plans, seek and evaluate reasons and justifications, analyze and monitor one's own thinking processes, sustain intellectual curiosity, organizing information and ideas, persisting when answers are not apparent, and remain open-minded in exploring alternative views and generating multiple options (Dewey, 1933; Fogarty & McTighe, 1993; Huot, 1998; Marzano, 1993; McREL, 1997).

In this model, cognitive strategies have been classified as simple thinking strategies. They *often intrinsically possess a simple structure* such as underlining main ideas, outlining, and paraphrasing (Gagné, Briggs & Wager, 1988, p. 70).

Connecting Networks and Operations

Bridges between interactive prerequisites and complex thinking skills related to life situations are formed by means of linkages, schemata, and scaffolding. They interweave the levels of thinking with content through *elaborating the given material, making inferences beyond what is explicitly presented, building adequate representations, analyzing and constructing relationships* (Lewis & Smith, 1993, p. 133).

Different processes may create the connecting networks and operations to relate new conceptual meaning to previously established ones, to integrate new information into existing schemata, to restructure schemata, or to restructure experience (Ausubel, 1978; Dewey, 1933; Jonassen, 1996). Linkages from the connecting networks are critical because *in very simple terms, we remember those things for which we have made many linkages* (Marzano, 1993, p. 156).

Teaching strategies make a difference in learning outcomes (Underbakke, Borg & Peterson, 1993; Kauchak & Eggen, 1998; Merrill, Drake, Lacy, Pratt, & the ID2 Research Group, 1996). Methods of teaching also influence the type of learning outcomes. For example, a Socratic method, or the use of stories or case studies, or class discussions may produce different kinds of learning (Wilson, 1997, p. 11).

Teachers who provide ready-made rules and generalizations for students to memorize are following practices that interfere with the development of thinking skills (Glaser, 1941). Novelty and usefulness to real life, and tasks that are neither too easy nor too difficult, hold more promise for making goals meaningful than isolated, rote learning tasks. The synchronous development of thinking skills with a deepening of the knowledge base promotes higher levels of thinking (Cotton, 1997; Crowl et al, 1997; Weisberg, 1995). Cognitive development through layers of instruction,each elaborating on the previous levels, progressively moves the learner from simple to complex concepts and thinking processes (Reigeluth, 1987; Reigeluth cited in Wilson & Cole, 1992).

Thinking skills instruction produces gains on measures of learning and intelligence (28 studies cited in Cotton, 1997). This instruction includes multidimensional strategies, wait time after presenting questions or problems, and a variety of examples with think-aloud explanations. It may include cycles of analysis and a period of incubation or reflection (Crowl et al, 1997; Facione, Sanchez, Facione & Gainene, 1995; Pogrow, 1990; Pogrow & Buchanan, 1985). Practical methods for infusing thinking into curriculum and instruction include the ones listed below (APA, 1997; Dewey, 1933; Glaser, 1941; Huot, 1998; Kauchak & Eggen, 1998; Marzano et al, 1988; McREL, 1997).

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- Encourage positive attitudes, perceptions, and motivation about learning in a supportive and safe learning environment with respectful and caring relationships.
- Emphasize acquisition of meaningful knowledge, especially procedural knowledge as a base for applied thinking.
- Link, extend, and deepen knowledge through thinking skills applied to relevant, authentic, real-life learning tasks.
- Use knowledge and skills in meaningful authentic tasks over a period of time.
- Develop dispositions, habits of mind, or habits of reflection for organizing information and thinking and learning processes, including creative and critical thinking.

In addition, it is important to provide the following.

- Alignment in content and complexity of tasks, assessment activities, and objectives (Kauchak & Eggen, 1998).
- Deliberate design of activities and programs to teach specific thinking and learning strategies along with self-monitoring, self-reflection, and evaluation (Cotton, 1997; Darmer, 1995, abstract; Easterwood, 1996, abstract; Glaser, 1941; Kauchak & Eggen, 1998; Perkins & Salomon, 1989).
- Directions on use of cognitive strategies such as methods of rehearsal, elaboration, organization, reflection, and paraphrasing to improve one's own learning (Cotton, 1997; Crowl et al, 1997).
- Novel problems and questions to evoke thinking (Dewey, 1933; Kauchak & Eggen, 1998).
- Emphasis of broad problem solving strategies, algorithms, or heuristics (Crowl et al, 1997; Kauchak & Eggen, 1998).
- Clarity of instructions and assignments, e.g., explain the nature of the thinking task (Kauchak & Eggen, 1998).
- Organized activities and structure for processes (Kauchak & Eggen, 1998).
- Choices among assignments (Kauchak & Eggen, 1998; Crowl et al, 1997).
- Emphasis on transfer of skills to everyday life situations by including conditions of real-life in practice opportunities (Kasonen & Winne, 1995; Perkins & Salomon, 1989;.
- Scaffolding of just enough support to guide students until they can perform skills independently (organizing frameworks, hints, questions, examples with explanations, modeling, corrective and specific feedback) (Kauchak & Eggen, 1998; Slavin, 1995; Vygotsky in Crowl et al, 1997; McREL, 1997).
- Explanation and modeling of habits of thinking and dispositions such as persistence (Crowl et al, 1997; Kauchak & Eggen, 1998).
- Activities that use various types of intelligences and encourage intellectual diversity (Gardner in Crowl, 1997; Gardner cited in Kauchak & Eggen,1998;Kauchak & Eggen, 1998; Merrill, 2000).
- Open-ended tasks involving several ways to resolve difficulties or solve problems and that give opportunities for small groups to contribute to outcomes (Kauchak & Eggen, 1998).
- Visual and verbal representations and explanations (drawings, graphs, maps, tales, hierarchies, lists of steps) (Clarke, 1990; Crowl et al, 1997; Glaser, 1941; Kauchak & Eggen, 1998).
- Practice in making inferences, in deciding how and when to apply different types of thinking skills, and in producing outcomes for a variety of life situations (Crowl et al, 1997; Howe & Warren, 1989; Kauchak & Eggen, 1998).
- Frequent, short assignments to include learning of prerequisite knowledge and skills and drill and practice using verbal analogies, logical reasoning, inductive and deductive thinking, and discrete steps and linkages involved in complex thinking processes (Kauchak & Eggen, 1998).
- Varieties of structured peer tutoring, cooperative learning, collaborative small group work, team assisted individualization with individual responsibilities and group products (Kauchak & Eggen, 1998; Kewley, 1996, abstract). [Social interaction is one of the vehicles by which learners share information (Vygotsky cited in Crowl et al, 1997)].
- Small group discussions only after assuring presence of prerequisite content knowledge and thinking skills (Kauchak & Eggen, 1998).
- Limited direct teaching, and if used, focus on mini-lectures combined with activities such as guided practice, demonstrations, debates, student questions, reviews and summaries (Patrick, 1986; Crowl et al, 1997; Kauchak & Eggen, 1998).
- Questioning strategies to stimulate curiosity of all learners, beginning with lower-order questions and progressively leading up to more complex questions (Crowl et al, 1997; Kauchak & Eggen, 1998).
- Monitoring, feedback, redirection, and correction of inefficient or incorrect strategies and pursuit of dead-end or simplistic answers (Cotton, 1997; Crowl et al, 1997).

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- Feedback in the form of informal checks, immediate, with positive emotional tones, specific and non judgmental, simple correction of errors without overexplaining (Crowl et al, 1997; Kauchak & Eggen, 1998).
- Reinforcement and encouragement of targeted thinking skills and progress of learners to develop their confidence and a greater sense of locus of control (Cotton, 1997; Crowl, 1997).
- Adaptations for diverse learner needs (Kauchak & Eggen, 1998).
- Mastery skills development and test management for subskills and prerequisite knowledge (Kauchak & Eggen, 1998).

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